

19 April 1971

MEMORANDUM FOR: 

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SUBJECT : Conference at the USAF Aerospace  
Cartographic and Geodetic Service  
at Forbes AFB, Topeka, Kansas,  
7 April 1971

1. The last conference of the DoD program of technical exchange with civil MC&G agencies included a very interesting briefing and several displays of ground equipment and of equipment fully installed and operating in RC-130A and RC-135A aircraft. The Aerospace Cartographic and Geodetic Service (ACGS) is one of four technical outfits under the Military Airlift Command. The ACGS is comprised of nine squadrons: two flying squadrons, three maintenance squadrons, one ground communications and electronics squadron, one data and photographic squadron, one geodetic survey squadron, and the headquarters squadron supporting the commander and his staff. The Commander is Colonel Leon M. Tannenbaum.

2. In the past the ACGS operated in many remote areas of the world and, as a result, was organized into a number of Aerial Survey Teams (ASTs). Each team is a closely coordinated and flexible, self-sustaining organization established to gather aerial photographs and geodetic data. The men for the ASTs are normally rotated since the work is conducted on a temporary duty basis. AST-4 was assigned to Ethiopia where mapping of almost the entire area was completed by the end of 1964. AST-2 had mapped about 80 percent of Liberia during a period from 1967 to 1969. AST-3 operated for some time in SEA and covered 98 percent of South Vietnam, gathering data under combat conditions. Approximately 130 men served with AST-3. AST-10 was the largest project undertaken by ACGS. It closed down operations on September 20, 1970, while it was based at Brasilia, Brazil. The project began in 1964.

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Before operations ceased the ACGS had three RC-130A aircraft flying cartographic photography and two RC-135A aircraft flying electronic geodetic surveying missions using the AN/US Q-28 aerial electro-photo mapping system developed by Kollsman. Also stationed at Brasilia were three CH-3E helicopters for ground station support work. Total personnel numbered 230 men. In addition to much of Brazil, this AST also covered sections of Colombia, Bolivia, Peru, Paraguay, Equador, and an important section of the Argentine-Chilean border. AST-6 is based at Forbes Air Force Base. It conducts assigned operations within the continental limits of the United States.

3. At the present time the ACGS is being reduced to a "hard-core" outfit. At one time having a personnel strength of 2,200 men, it is now close to 900 and will be further reduced because of DoD's efforts to slash some areas for economy's sake. But the esprit-de-corps remains. All or nearly all of the ASTs abroad have been phased out, leaving the AST-6 based at Forbes AFB to undertake contingency, non-military flying jobs like photographing earthquake areas, covering parts of Alaska with B&W, color, and infrared photography, and doing special jobs for the USGS and NOAA. No funds were allowed in the current budget for foreign ACGS air operations, so the four complex RC-135A aircraft with the Q-28 configuration are not being used effectively.

4. The ACGS continues its ground operations, which are performed by the 1st Cartographic and Geodetic Survey Squadron. These operations include precise calibration and instrumentation surveys for both the USAF Western Test Range in California and the Eastern Test Range in Florida. The ground operations also include precisely accurate launch site surveys for the SAC missile force and for NASA's space program.

5. While foreign aerial photography for mapping and geodetic trilateration was being undertaken, ground teams had to "rough it". Many of the temporary stations they manned were in remote areas, often accessible only by helicopter. But their radar installations were an essential element for both accurate mapping

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photography from the large aircraft and for building a trilateration network (triangulation from the air using the aircraft's accurate positioning obtained by radar-determined distances from known stations to establish the position of new unknown stations in the network buildup.

6. The HIRAN (High Precision Short Range Navigation and an outgrowth of SHORAN) system has been in use for many years. Radar signals are transponded from two ground stations to the aircraft to accurately position the aircraft with reference to the known ground points. The standard of accuracy is about  $\pm 12$  feet. Altitude above the ground is determined by a narrow-beam radar terrain profiling recorder (TPR). The RC-130A uses this system primarily in locating the camera positions in cartographic mapping. It can also be used for determining accurate geodetic distances between two ground points.

7. The RC-130A has three cameras on board. Some are interchangeable, but I had the impression that two KC-6A six-inch focal length vertical frame cameras were most commonly used, on stabilized mounts, with a third camera which could take obliques by opening the rear loading hatch, using 12-inch, 24-inch, or 36-inch focal length lenses.

8. The RC-135A jet aircraft has the Q-28 mapping and geodetic system installed. It has an extremely precise inertial navigation system. This system provides a much faster and more accurate means of obtaining aerial photographic and geodetic information than does the RC-130A aircraft. There is provision for data recording and supporting electronics. (See attached brochure on the Q-28 system)

9. The SHIRAN navigation system is part of the overall Q-28 system. As opposed to HIRAN, which can read only two ground transmitters at one time, SHIRAN can read four to measure distance to ground stations, known and unknown. This is an efficient method of building up trilateration control networks over large areas. SHIRAN ground stations have 50-foot masts and provide accuracies of 18 feet within 50 nautical mile distances. The RC-135A normally has two cameras for work in foreign areas because the host country always wants one ON. Only the ON kept by the ACGS has altitude data. The RC-135A

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with the Q-28 system also provides airborne terrain profiling, and conducts aerial photography for mapping. The photographer at his console can, through his viewfinder, manipulate the positioning of the two KC-6A cameras by control of the camera mounts in order to maintain verticality.

10. Both of the systems installed in the RC-130A and the RC-135A can and have been used for calibration of Loran C hyperbolic curve coordinates against simultaneous photographic point positioning from ground imagery. This type of navigational system in targeting allows for point positioning for use between aircraft and artillery. This positioning system was most useful in the Indochina area.

11. The RC-135A has a maximum endurance of about 10 hours, if distance is required for survival. It normally flies at 30,000 plus feet for about 6 hours. At 40,000 feet with 65,000 pounds of fuel, with the Q-28 system on board, it can fly about four hours of photographic effective time.

12. The 1st Cartographic and Geodetic (ground) Processing Squadron will have been reduced in strength from 200 to 50 by 1 July 1971. The management line runs from DIA through Hdqs. USAF, to Military Airlift Command (MAC), to ACGS. In this Squadron, there is centered the planning for photo-mapping and trilateration surveying, including the positioning of temporary ground stations. This Squadron also receives the results of the surveys undertaken by the airborne missions and ground stations and evaluates the results with a representative of the consumer, such as an officer from TOPOCOM, one of whom is permanently assigned to this Squadron. Film, with stereo-overlap, prints, and data on each frame are provided to the consumers.

13. Although the equipment developed has been costly and imagery that would be perhaps adequate of some purposes, but not as precise, might be done by regular reconnaissance aircraft, it seems to me that this highly developed air photo and geodetic survey capability is being largely wasted just to accomplish relatively minor savings in the DoD budget. Of course, the

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potential results of oncoming systems might be in the minds of the DoD budget people. On the other hand, these large, specially equipped planes are excellent platforms for all-weather topographic mapping systems using coherent high resolution side-looking radar with interferometer equipment, but only the all-weather system on the RC-130A will be operational--within about a year.



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TECHNICAL EXCHANGE MC&G VISIT TO ACGS7 April 1971

|               |           |  |
|---------------|-----------|--|
|               | 0915      | Bus Departs Holiday Inn (South) for Base Theater   |
|               | 0930-1000 | Registration and Free Coffee and Doughnuts,<br>Base Theater                                  |
|               | 1000-1010 | Commander's Welcome,<br>Base Theater.  |
|               | 1010-1045 | ACGS Mission Briefing, Base Theater.   |
| (Group 1)     | 1050-1130 | Tour of Electronic and Photographic Maintenance<br>Facility, 1st AMSq.                       |
|               | 1135-1235 | Lunch  |
|               | 1240-1315 | HIRAN/SHIRAN Ground Station Static Display,<br>1st GCESq (Bldg 625).                         |
|               | 1320-1420 | Tour of Computations, Photo Processing, and<br>Photo Evaluation Facility (ES-75), 1st CGPSq. |
|               | 1425-1525 | RC-130A and RC-135A Static Display, Flight Line.   |
|               | 1530      | Depart ACGS Parking Lot for Kansas City Airport.   |
|               | 1540-1600 | Critique, Hq Conference Room (for those<br>remaining).                                       |
| (Group 2)     | 1050-1125 | HIRAN/SHIRAN Ground Station Static Display,<br>1GCESq (Bldg 625).                            |
|               | 1130-1210 | Tour of Electronic & Photographic Maintenance<br>Facility, 1AMSq.                            |
|               | 1215-1315 | Lunch.   |
|               | 1320-1420 | RC-130A and RC-135A Static Display, Flight Line.   |
|               | 1425-1525 | Tour of Computations, Photo Processing and Photo<br>Evaluation Facility (ES-75), 1CGPSq.     |
|               | 1530      | Depart ACGS Parking Lot for Kansas City Airport  |
|               | 1540-1600 | Critique, Hq Conference Room (for those<br>remaining).                                       |
| (Group 1 & 2) | 1600-1700 | Free time.   |
|               | 1700      | Cocktail Party Frontier Room of the Officers Club,<br>followed by dinner, if desired.        |